Using 3-dimensional velocity models and reference seismic events to improve seismic locations in the Mediterranean, North Africa, Middle East and Western Eurasia

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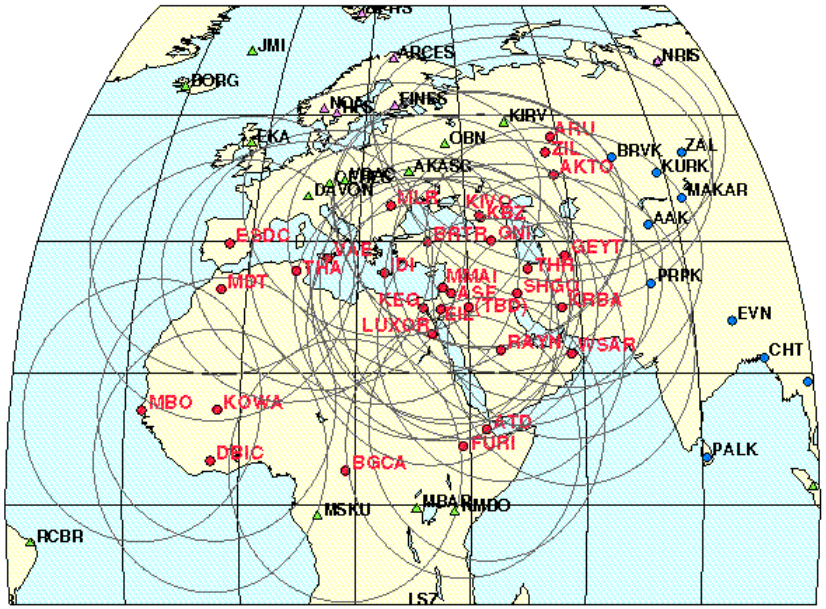
Overview



- Objectives
- Who are we?
- 3D model development
- Collection of reference events
- Conclusions

Objectives

Improve locations based on the sparse IMS network, reduce location bias and uncertainties

Calculate regional travel times (Pn, Sn, Pg, Lg) for selected stations in the region by ray-tracing through a 3D model

- Develop 3D models (global/regional body/surface wave tomography, regionalized models)
- Represent predicted travel times as correction surfaces centered on stations relative to IASPEI91
- Collect reference events located with 5 km accuracy or better
- Validate models and corrections using reference events (demonstrate that locations improve)

Who are we?

SAIC - Coordination, regionalization, reference event collection, software integration, testing, validation

University of Colorado, Boulder - Regional body/surface-wave tomography, 3D ray-tracing, reference event collection

Harvard University - Global/regional body/surface-wave tomography, reference event collection

University of California San Diego - Model validation, regionalization

Multimax - Reference event collection and analysis

Geophysical Institute of Israel – Reference event collection and analysis

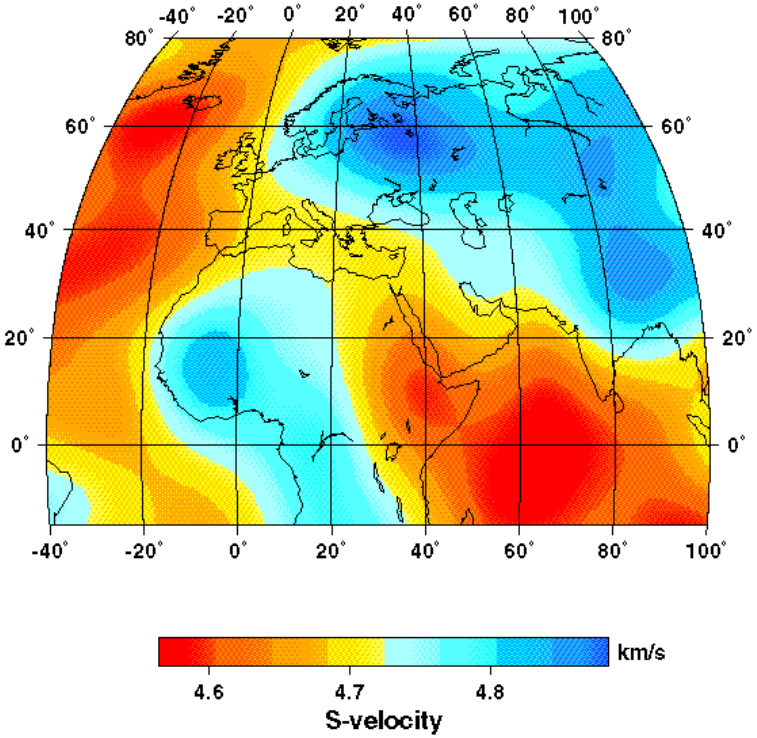
Consortium: 3 year project

- Project started in April, 2000
- Task: deliver correction surfaces for IMS stations in the region
- First delivery, June 2001:
  - models based on existing data and models, preliminary correction surfaces for surface sources, reference event list
- Final delivery, January 2003:
  - Final models, refined, depth-dependent correction surfaces, reference event list
- Web site: http://g2calibration.cmr.gov

Model development

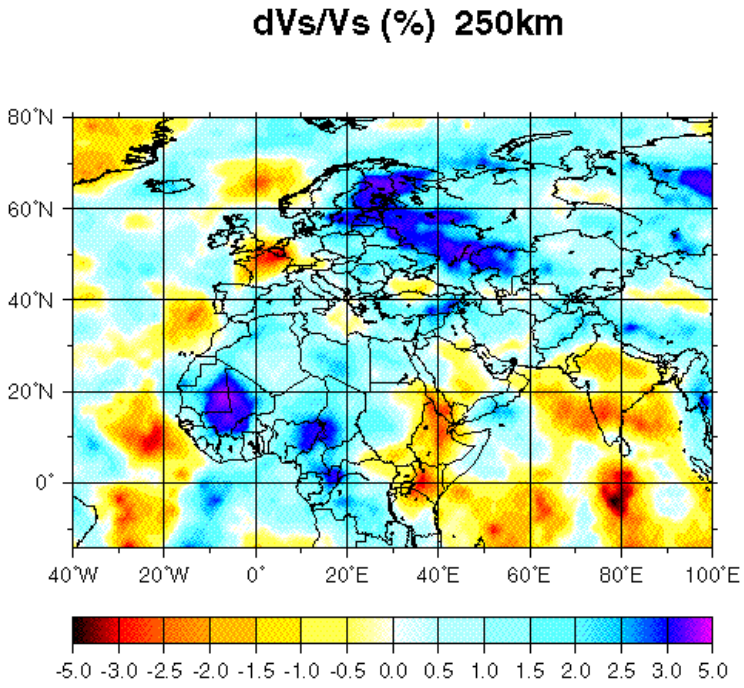
Harvard 362S, 250 km

- Whole mantle, no crust

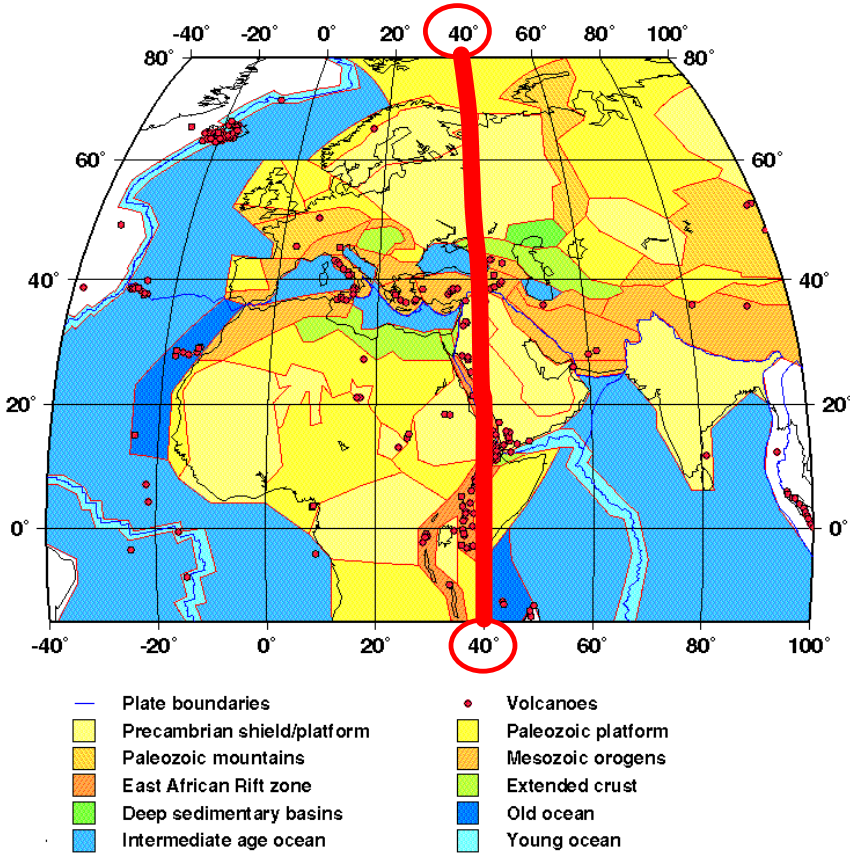


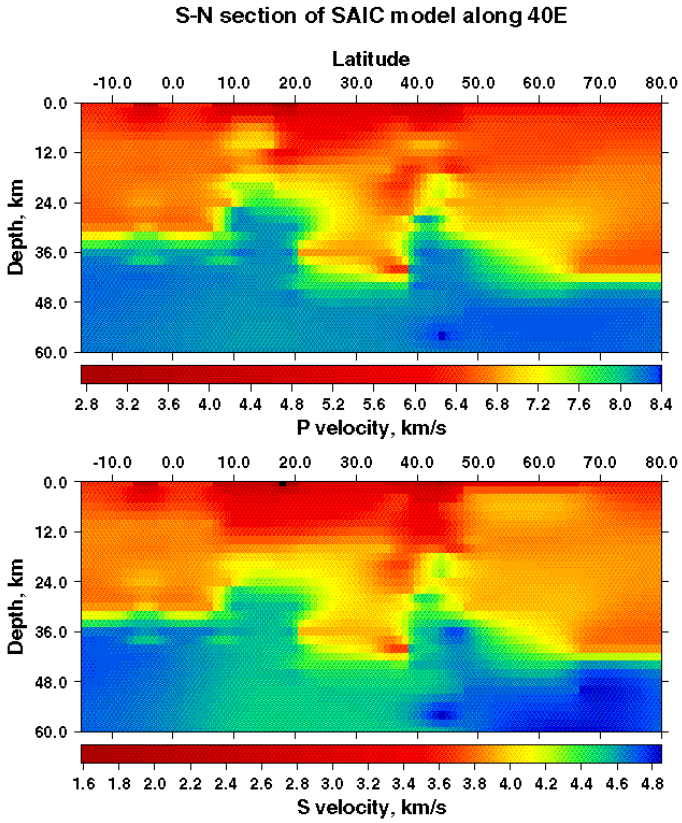
Colorado S, 250 km

- Upper mantle + CRUST5.1



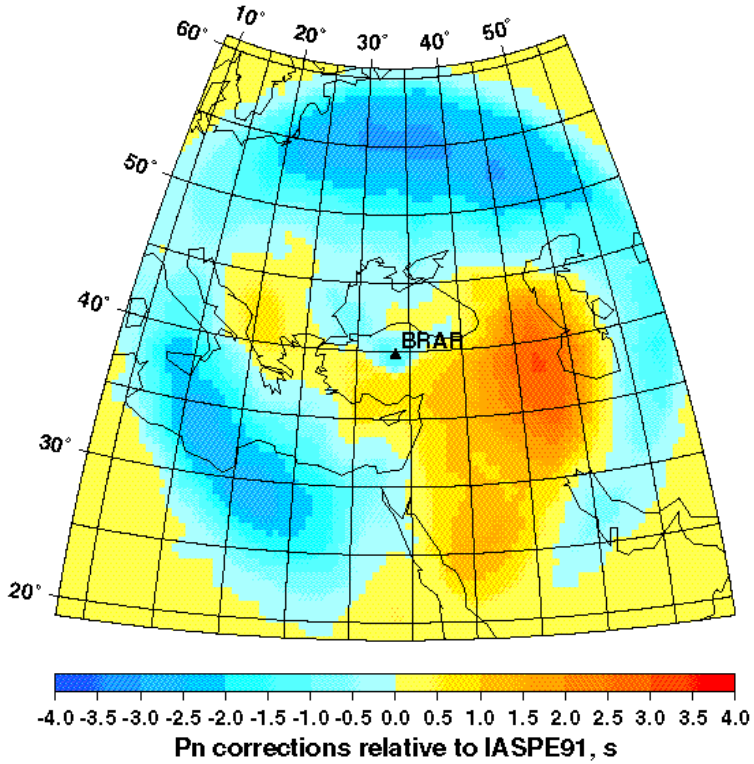
Model development



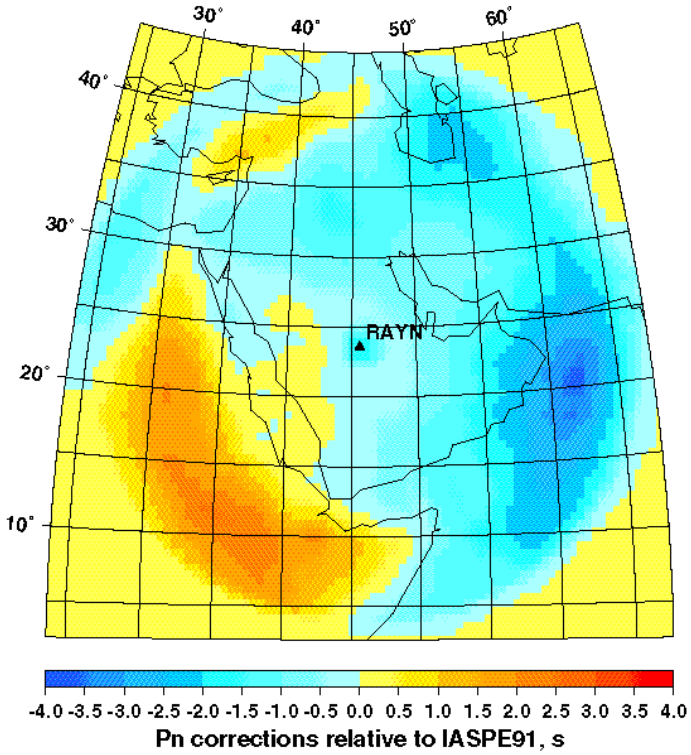


Correction surfaces

Belbasi array, Turkey



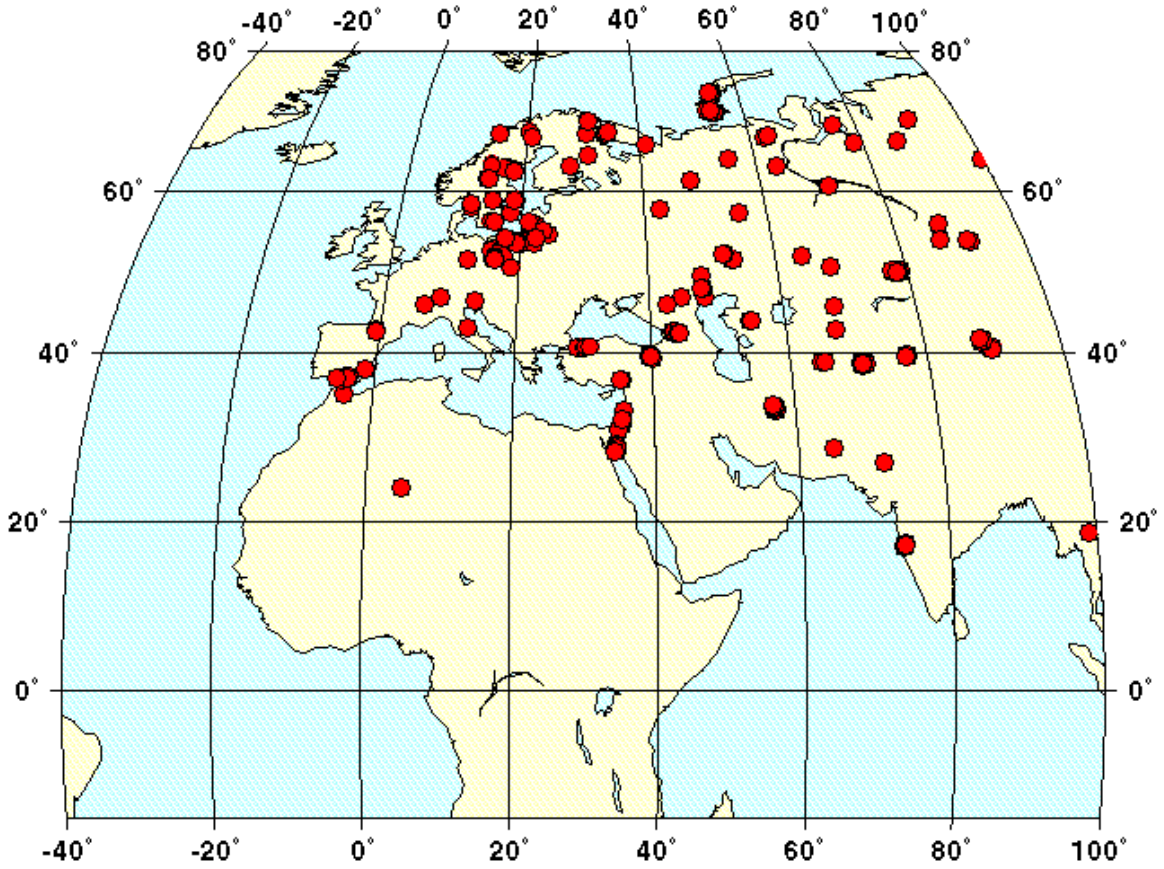
Ar Rayn, Saudi Arabia



Collection of Reference Events

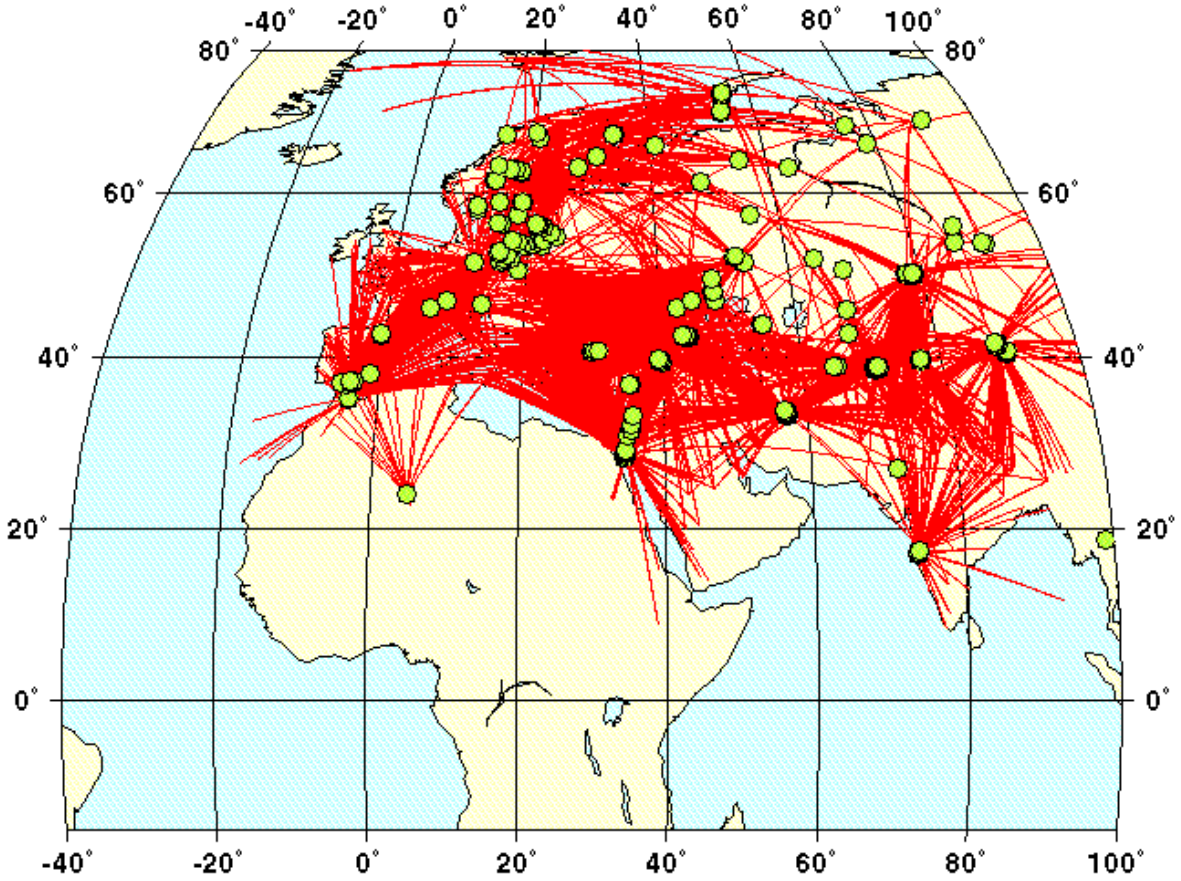
- A high-quality set of reference events is crucial for model validation
- What is a reference event?
  - GT0: known (published) location of explosions
  - GT2: event tied to a mine with a size ~2 km
  - GT5: local seismic network location
    - 10 or more stations within 250 km with maximum azimuthal gap <= 120 degrees;
    - closest station <= 30 km;
    - P/Pn recorded beyond 250 km;
    - event located using a local velocity model
    - **Origin time might still be biased!**
- Each reference event is validated and documented

Distribution of Reference Events, March 15



Download: http://g2calibration.cmr.gov

Regional ray coverage, March 15



Poor coverage in Africa, Middle East and NE Eurasia

Conclusions

- A Consortium was formed to develop and test 3D models in the Mediterranean, North Africa, Middle East and Western Eurasia
- Correction surfaces relative to IASPEI91 can be provided for any stations in the region
- Reference events are needed to validate the models
- Reference event coverage is poor in the Middle East and North Africa
- We invite researchers:
  - join the effort in collecting reference events
  - evaluate predicted travel times from 3D models